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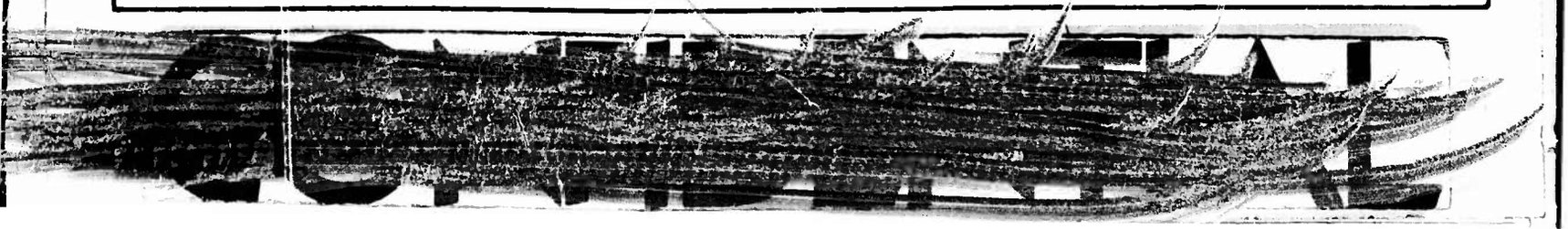

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Guided Missile Personnel Research: Report No. 4

A COMPARATIVE ANALYSIS OF MISSILEMAN TASKS FOR FIVE GUIDED MISSILES

Volume 3. Appendices F and G

Component Breakdown of Missiles and Associated Equipment

Prepared under the Sponsorship of the

BUREAU OF NAVAL PERSONNEL

BUREAU OF NAVAL PERSONNEL

Technical Bulletin

A COMPARATIVE ANALYSIS OF MISSILEMEN TASKS FOR FIVE GUIDED MISSILES

Volume 3. Appendices F and G.

COMPONENT BREAKDOWN OF MISSILES AND ASSOCIATED EQUIPMENT; AND LISTINGS OF STANDARD TEST SETS

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C O N T E N T S

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COMPONENT BREAKDOWN OF MISSILES AND ASSOCIATED EQUIPMENT;
AND LISTINGS OF STANDARD TEST SETS

APPENDIX F

TROUBLE SHOOTING: DETAILED COMPONENT BREAKDOWN OF MISSILE AND ASSOCIATED EQUIPMENT

TERRIER

Name of Circuit, Stage, or Part	Function, if not Described by Name
Missile	
1. Receiver	
Crystal detector	Mixer
Reflex klystron oscillator with AFC	Local oscillator
Stagger tuned if amplifier	If amplifier
Crystal detector	Pulse detector
Video amplifier, pentode	
Crystal diode rectifier	Pulse shaper
Pulse stretcher, diode rectifier and triode amplifier	Pulse stretcher
Diode detector	
Crystal diode clamp	
Blocking oscillator	Reference channel blocking oscillator
Triode amplifier	
FM discriminator	Reference channel FM discriminator
Cathode follower	
Pulse amplitude detector with automatic discharge	Box car detector
Ring rectifier phase detector	AFC system
Triode dc amplifier	Flight limiter
Cathode and plate loaded triode amplifier	AFC amplifier
Cathode follower	

Name of Circuit, Stage, or Part	Function, if not Described by Name
2. Intelligence Converter	
Pentode amplifier	Error amplifier
Cathode coupled phase inverters	Error driver Reference driver
R-C lattice phase shifter	Reference phase splitter
Ring demodulator and phase comparator	Phase comparator
3. Computer (A and B channels)	
R-C phase shift network and filter	Rate network
Cascade triode dc amplifier	
Diode limiters	Fixed limiter; First limiter; Integral limiter
Resistor attenuator	Gain change network
Cathode coupled regenerative amplifier with delayed feedback	Integrating amplifier
Cathode follower	Output cathode follower
4. Servo Amplifier (A, B and Roll Channels)	
Cathode coupled phase inverter	Servo driver
Push-pull power amplifier	Servo power amplifier
Balancing potentiometer	Trim potentiometer
Feedback network	Solenoid valve; hydraulic actuator; feedback potentiometer
Triode amplifier	Roll error amplifier
Ring demodulator	Roll demodulator
Roll sensitivity controller	Roll rate gyro
5. Roll System Units	
Note: Demodulator, dc amplifier and servo amplifier covered by breakdown on A and B channels	
Free gyro	Roll gyro
Synchro data system	Roll system syndron
Bellows altimeter	Altitude compensating circuit
Vacuum tube attenuator	Gain change amplifier

Name of Circuit, Stage, or Part	Function, if not Described by Name
6. Programmer	
Induction motor and gear train	Program timer motor
Cylindrical potentiometer	Position potentiometer; $F_1(t)$; $F_2(t)$ (A); $F_2(t)$ (B)
Cam actuated microswitches	Programmer switches
Pentode dc amplifier	
Timing circuit using condenser dischange	Time to intercept circuit
7. Electrical System (power supply)	
Induction alternator	
Three phase full wave rectifier	
Series regulator tubes, vacuum	
Shunt regulators, gas tube	
Dc amplifier couplers, gas tube	
Triode dc amplifier	
Triode dc amplifier, compensated	
Selenium rectifiers	Low voltage supply

8. Power Changeover System

Consists of relays, solenoids and switches to change power supply source and to activate gyro components immediately prior to launching.

9. Booster Firing System

Consists of relays and switches to effect normal launching and provide for emergency launching of missile.

10. Pneumatic-Hydraulic System	
Air storage bottle	
Solenoid actuated air valve	Air shut-off valve
Check valve	
Air pressure regulator	
Double acting gas driven liquid pump	Autopac
Hydraulic sump	Sump

Name of Circuit, Stage, or Part	Function, if not Described by Name
10. Pneumatic-Hydraulic System (Cont'd)	
Rotating piston hydraulic motor	
Liquid flow regulators	
Solenoid valve controlled piston	Actuator
Testing and Servicing Equipment	
11. Flight Ready Indicator	
D'Arsonval current meters	A channel meter; B channel meter; Roll channel meter
Motor driven timer	1st 2 min. timer; 2nd 2 min. timer
Relay switches	
Selector switch	Rotary switch
Vacuum tube amplifier, transformer coupled	Tube
Resistor voltage dividers	Voltage dividers
12. BuOrd Functional Test Equipment	
X Band microwave signal generator w/AFC	Data for desired breakdown of this unit not available.
Waveguide with motor driven attenuator	Modulator
Magnetic pick off wheel	Modulator
Mechanical differential	Modulator
Syndromes motor interval timers	Disk indicators
Panel voltmeters	
Commutator transducer	Transducer
Potentiometer transducer	Transducer
6 channel heat writing recorder	Rahm Recorder
In addition to the above items equipment includes ordinary relays, switches, indicator lamps, etc.	
13. Monitoring Panel	
13.1 Main Chassis	
Synchro transformer	Roll corrector synchro
R-C network	Phase rotation sensing net

Name of Circuit, Stage, or Part	Function, if not Described by Name
13.1 Main Chassis (Cont'd)	
Time delay relay	Synchronous timer
R-C network	Phase shifting network
Tuner	Synchronous timer
Fan	Cooling blower
13.2 Sine Wave Chassis	
Graham drive unit	Signal generator driver
Potentiometer	Sine wave generator
Synchro generator	
Dry disc rectifier	Bridge Power supply
13.3 Electronic Chassis	
Full wave rectifier	Power supply
L-C filter	Power supply filter
VR tube	Voltage reference
Series regulator tube	
Dc amplifier	Regulator control tube
Dc amplifier	
Cathode follower	Impedance transformer
VR tube	Voltage regulator
VR tube	Interstage coupling
Af amplifier	Triode
Demodulator	Phase sensitive diode demod.
Grid clipper amplifier	Triode
Multivibrator	Monostable
R-C filter	30 cps filter
14. Monitoring Panel Test Unit	
14.1 Main Chassis	
Synchro transformer	Fixed synchro
Synchro generator	

Name of Circuit, Stage, or Part	Function, if not Described by Name
14.2 Electronic Chassis	
Full wave rectifier	Dc power supply
Bridge rectifier	Dry disc rectified dc supply
L-C filter	Power supply filter
VR tubes	Voltage reference
VR tubes	Coupling tubes
Series regulator	
Dc amplifiers	Voltage regulator control
Dc amplifiers	
Polarized relay	Micro-Positioner
15. Radar Beam Simulator	
15.1 Rf Chassis	
Pulse modulating tubes	High voltage negative pulses of uniform magnitude
Clamping tube	Insure identical pulse voltage for successive pulse groups
Klystron oscillators	Source of X band energy
Voltage amplifier tubes	Amplify 30 cps voltage
Cathode follower	Phase inverter
Power amplifier tubes	Supply 30 cps output
Voltage amplifier tubes	Amplify 30 cps signal from transducer
Cathode follower	Supply voltage for V103A
Voltage regulator tubes	Maintain constant B^+ for meter amplifier tubes
Dry disc rectifier bridge	Provide dc voltage for AM meter
15.2 Pulse Coding Chassis	
Note: This chassis provides capture and guidance codes. This material is classified Secret and will not be included in this report.	
15.3 Automatic Frequency Control	
Ac amplifier tube	Amplify 45 mc difference component of AFC crystal output

Name of Circuit, Stage, or Part	Function, if not Described by Name
15.4 FM Generating and Phasing Chassis	(Cont'd)
Cathode follower	Supply signal for 3-p
Paraphase amplifier	Determine delay on V316 and V318
Cathode follower	Supply signal for FM delay circuit
Pulse rectifier (series selector)	Remove positive portions of 1350 cps pulses
Reactance tube	FM delay
Limiter	Pulse shaping
Grid rectifier	Stabilizer for 318
Cathode follower	Supply signal to pulse shaper
Pulse shaper	
Pulse amplifier	Amplify shaped pulse
Cathode followers	Supply signals for outputs
Relay	Selects 30 cps output or 30 cps oscillator load
Flight limitation selector relay	Select 100 pps or 1350 pps
Remote-Local relay	Select remote or local operation of beam simulator
Cathode follower	Supply 30 cps output
Pulse amplifier	Amplify 1350 pps signal
15.5 -105 Volt Power Supply Chassis	
Power transformer	Supply for rectifiers
Rectifier tubes	-105 and -210 volt supplies
Filter sections	-105 and -210 volt supply filters
Series voltage regulator tubes	Regulator -105 volt output
Amplifier tube	Control for voltage regulators
Shunt voltage regulator tube	Regulate -210 volt output
15.6 Low Voltage Power Supply Chassis	
Power transformers	Supply for rectifiers
Rectifier tubes	+300 and -105 volt supplies
Bridge rectifier, dry disc type	+28 volt dc supply

Name of Circuit, Stage, or Part	Function, if not Described by Name
15.6 Low Voltage Power Supply Chassis	(Cont'd)
Filter reactions	+300 and -155 volt supply filters
Series voltage regulator tubes	Regulate +300 volt outputs
Amplifier tubes	Control for voltage regulators
Voltage reference tubes	Reference voltage for amplifiers
Shunt voltage regulator tube	Regulate -105 volt output
Time delay relay with bi-metal heater	
15.7 High Voltage Power Supply Chassis	
Power transformers	Supply for rectifiers
Full wave rectifiers	+700 and -1100 volt supplies
Filter sections	+700 and -1100 volt supply filters
Series voltage regulator tubes	Regulate +700 and -1100 outputs
Amplifier tubes	Control for voltage regulators
Voltage reference tubes	Reference voltage for amplifiers
Time delay relay with bi-metal heater	
16. Beam Analyzer	
16.1 Rf Panel	
If Amplifier tubes	Amplify mixer output
Detectors	Dc voltages for VTVM
Cathode follower	Signal for video amplifier
Oscillator tube	Signal for 45 MCS generator
15 MCS crystal	Control for 1-d
Attenuator	
Discriminator	Centered at 45 MC-output to VTVM
Detector	Supply signal for 1-c
Limiter	
Dc amplifier	Supply test signal for synchroscope
Local oscillator	45 MCS from incoming rf signal
Oscillator	400 cps output
Amplifiers	Amplify 400 cps outputs from 1-m and AGC detector

Name of Circuit, Stage, or Part	Function, if not Described by Name
16.1 Rf Panel	
Discriminator	Compare 400 cps signals from oscillator 1-m and AGC detector
Cathode follower	Supply AGC 400 cps signal to phase comparator circuit
Amplifier	VTVM
16.2 AGC and Decoder Panel	
Amplifiers	Video pulse and stretched video pulse amplifiers
Cathode followers	Low driving impedance for decoder delay line and pulse stretcher
Pulse stretchers	Stretch video and locking oscillator pulses
Cathode follower	Supply signal for clamp tubes
Clamp tubes	AGC detector
Blocking oscillators	
Limiter	Trigger pulse for blocking oscillator from stretched video pulse
Cathode followers	Output signals for AGC
Clamp	Maintain constant grid bias on V218A
Cathode follower	Signal for blocking oscillator & AGC detector
Clipping amplifier	Clip and amplify stretched pulses from CR209
Discriminator	1350 pps centered
Dc amplifiers	VTVM
Rectifier	Meter zero-calibration
Diode detector	Dc voltage proportional to FM to VTVM
Amplifier	Amplify 30 cps output trim discriminator
Cathode follower	30 cps signal to comparator chassis
Oscillator tubes	Pulse source -PRF = 30 cps

Name of Circuit, Stage, or Part	Function, if not Described by Name
16.2 AGC and Decoder Panel (Cont'd)	
Cathode followers	Decrease recovery time for 2 cps
Clamping diode	
Pulse amplifier	Amplify pulse from PRF generator
Cathode follower	Supply pulses for calibration of AGC
16.3 Synchroscope	
Multivibrator	Supply signal for voltage calibration
Clipper	Remove neg. pulses from calibration signal
Crystal	Video detector for rf input
Attenuator	Attenuate input signal
Delay line	Delay video signal
Amplifiers	Vertical amplifiers for input signal and signal from marker generator
Pulse generating tubes	Timing marker pulses
Delay lines	Determine timing pulse widths and delays
Series clipper	Shape marker pulses
Amplifiers	Amplify trigger signals for V318B and V302B
Blocking oscillators	
Amplifiers	Amplify output of blocking oscilator
Clipper	Supply dc signal for vertical plates
Clippers	Clip output of blocking oscillators
Limiter	Supply delayed signal for "A" sweep
Gate	Supply pulses for fast sweep generator
Amplifier	Amplify output pulses of gate
Saw-tooth generators	Fast and slow sweep signals
Charging diode	

Name of Circuit, Stage, or Part	Function, if not Described by name
16.3 Synchroscope (Cont'd)	
Switch	Signal to sweep follower
Cathode follower	Supply signal to inverter
Amplifier	Inverter - sweep signal to scope
Amplifiers	Amplify signals from 3-
Cathode follower	Signal for intensity control
Cathode ray tube	
Voltage regulator tubes	Regulate voltage on intensity control
Full wave rectifier	Low voltage power supply
Filter	Low voltage power supply
Series voltage regulator	Low voltage power supply
Voltage amplifier	Low voltage power supply
Voltage reference tube	Constant cathode voltage for V808
16.4 Comparator Panel	
Selenium rectifiers	Rectify error and reference signals
Dc amplifiers	Amplifier error signal
Phase splitter	Supply signal to lead and lay networks
Amplifiers	Amplify error signal
Cathode followers	Supply error and reference signals to comparator

16.5 Reference Generator

This panel consists of a synchronous motor and two permanent magnent a-c generators. Two 30 cps signals can thus be generated with adjustable phase relation and fed to any other panel.

16.6 Power Supply Panel	
Full wave rectifiers	Dc voltage for t250, t200, t110 and -200 volts supplies
Filter	Filters for 6-a
Series voltage regulators	Regulate output of 6-b
Dc amplifiers	Amplify dc output voltages
Voltage reference tubes	Reference voltage for dc amplifier tubes

Name of Circuit, Stage, or Part	Function, if not Described by Name
17. Receiver Test Panel	
17.1 Power Supply Chassis	
Full wave rectifier	Power fupply
L-C filter	Dc power supply pi filter
Voltage reference tube	VR tube
Series regulator tubes	
Dc amplifier	Regulator control
Half wave rectifier	Relay supply (time delay relay)
17.2 Monitoring Chassis	
Half wave rectifier	Dry disc low voltage power supply
R-C filter	Dc power supply pi filter
R-C network	Simulated load network
Triode amplifier	Af amplifiers
R-C network	Phase shift circuits
R-C filter	Low pass filter
Cathode follower	Impedance transformer
17.3 Metering Chassis	
Full wave rectifier	Dc power supply
L-C filter	Power supply pi filter
Voltage reference tube	VR tube
Series regulator	
Dc amplifiers	Regulator control
Triode amplifiers	VTVM
Cathode follcwer	VTVM
Rectifier bridge	Meter rectifier
Dc amplifier	Bridge VTVM
18. Hydraulic Charging Unit	
Bordon pressure gage	Filter gage Air pressure gage
Manometer air pressure gage	Vacuum gage
Sight glass liquid level indicators	Sight gages

Name of Circuit, Stage, or Part	Function, if not Described by Name
18. Hydraulic Charging Unit (Cont'd)	
Air filter	
Liquid filters	Hydraulic filter Missile connection filter
Liquid reservoirs	Vacuum sump Hydraulic reservoir
Double acting hydraulic valves	Air valve Vacuum valve
Liquid pump	Hydraulic pump
Check valves	
Bordon temperature gage	Oil temp. gage
Pressure relief valve	

In addition to the above, simple shut off and by pass valves, electrical switches, relays and motors are incorporated.

REGULUS

Name of Circuit, Stage, or Part	Function, if not Described by Name
Bi-Polar Guidance	
1. Regulus Guidance Set	
1.1 Power Supply	
Three phase transformers	Plate transformer
Single phase transformers	Plate and filament transformers
Thyratrons	Power supply rectifier
Hard tube rectifier	Power supply rectifier
R-C filters	Power supply filtering
Regulated power supply	
1.2 Receiver	
Slug tuned cavity	Preselector
Silicon diode	Mixer
Lighthouse triode mounted in tunable cavity	Local oscillator
Pentode amplifier	Series voltage regulator
Triode grounded grid amplifier	If amplifier
Cathode degenerative circuit	To prevent changes in transconductance with changes in bias
VR tube	
Parallel resonant L-C circuits	Decoupling
Pentode amplifier	If amplifier
Diode detector	
Pentode amplifier	Video amplifier
Cathode follower	Impedance transformer
1.3 Decoder	
Pentode amplifier	Coincidence tube (control grid-suppressor grid coincidence)
Externally triggered blocking oscillator	Pulse source
Germanium diode	Negative clipping
Delay line	
Cathode follower	Isolation

Name of Circuit, Stage, or Part	Function, if not Described by Name
1.4 Program Unit	
Free-running blocking oscillator	Timer
Cathode follower	Isolation
Relay	Hold off, and release switching
Thyratron switch tube	Relay actuation
Cathode coupled monostable multivibrator	Gate voltage source
Triode	Gated discharge tube
Diode-condenser network	Counting circuit
Germanium diode	Non-linear coupling element
1.5 Director Unit	
Cathode coupled monostable multivibrator	Gate voltage generator
Diode	Dc restorer
Shock excited oscillator	
Diode	Clipper
Cathode follower	Isolation
Cathode coupled monostable multivibrator	Delay element
R-C network	Differentiator
Triode amplifier	Isolation
Triggered blocking oscillator	
Pulse transformer	Coupling
Diode, R-C network	Phase detection
Cathode follower vacuum tube bridge	Difference voltage generator, isolation
1.6 Encoder - Transmitter	
Triggered blocking oscillator	
Cathode follower	Isolation
Triode amplifier	
Delay line	Pulse delay
Thyratron	Switching
Half-wave voltage doubler	High voltage supply

Name of Circuit, Stage, or Part	Function, if not Described by Name
1.6 Encoder-Transmitter (Cont'd)	
Saturable reactor	Voltage regulator
Thermal switch	Current limiter until operating temperature is attained
Relay	Overload protection
Diode	Shunt protection for pulse forming network
Inductor	Charging inductance for pulse forming network
Diode	Charging diode for pulse forming network
Pulse forming network	Modulator
Pulse transformer	Modulator
Magnetron	Pulse transmitter
R-C networks	High-pass filter
Blower assembly	
1.7 Duplexer	
TR tube	
ATR tube	
Waveguide elements	
Cold cathode gas filled rectifier	Keep alive voltage rectifier
1.8 Electrical System	
(Only preliminary information available)	
24v wet battery	Main battery
6v wet battery	"Boost" battery
6v dry cells	Destruct battery
28v dc generator	
Carbon pile regulator	28v regulator
Inverter, 28v dc to 115v, 400 cps, 3 phase ac	
6 volt dry cells	Destruct battery
6 volt mercury cells	Instrumentation battery

Name of Circuit, Stage, or Part	Function, if not Described by Name
1.9 Stabilization Hydraulic System	
Constant displacement piston type, engine driven pump	Hydraulic pump
Sphere type accumulator and sump; charged with air to 1200 psi	
Supply manifold	
Pressure relief valve	
Return manifold	
Reducing volve	Receives oil at 2800 psi, reduces it to 1100 psi
Reduced pressure manifold	
1.10 Flight Path Controller	
Only limited information was available on the Flight Path Controller. The breakdown below is taken from the Lesson Plan Outline of the Point Mugu Regulus course.	
In general, in the Flight Path Computer, the dc output of the Director Unit is passed through a rate network, converted to a 400 cps ac signal with a "chopper", amplified, and limited. The output of the Flight Path Computer is fed to the autopilot.	
R-C networks	Rate control
400 cps "chopper"	Modulator
Amplifier	Triode
Biased diodes	Limiter
Triode amplifier	Output amplifier and wave shaper
Triode amplifier	Erection relay amplifier
Relay tube	Erection relay tube
2. Regulus Beacon	
2.1 Range Delay Unit	
Bistable multivibrator	Gate voltage generator
Cathode follower	Isolation
Triode amplifier	Gated shunt tube (shunts oscillatory circuit)
Hartley oscillator	8kc generator

Name of Circuit, Stage, or Part	Function, if not Described by Name
2.1 Range Delay Unit (Cont'd)	
Temperature compensated tank circuits	8kc oscillator
Strip heater	Oscillator temperature control
Thermostat switch	Oscillator temperature control
Blower (motor and fan)	Air circulation
Paraphase amplifier	Generates two signals of 90° phase relation when used in conjunction with special phase shift network
Pentode amplifier	High impedance cathode bias "resistor"
R-C network	Phase shifting
Cathode follower	Autosyn resolver stator winding driver (isolation)
Autosyn resolver	0 to 360° phase shifter
Pentode amplifier	
Multiar circuit	Pulse generator
R-C network	Differentiating circuit
Triode amplifier	Trigger amplifier
Blocking oscillator	Pulse generator
Bootstrap saw-tooth generator	
Triode	Gated shunt tube
Cathode follower	Isolation (test point)
Diode	Non-linear coupling device
Helipot	Bias adjustment
Triode amplifier	Trigger amplifier
Blocking oscillator	Pulse generator
Servo motor	
Gear train	
Veeder root counter	
Synchro generator	
Paraphase amplifier	Output polarity selector

Name of Circuit, Stage, or Part	Function, if not Described by Name
2.2 Range Tracker	
Bi-stable multivibrator with diode coupled trigger circuits and cathode follower output	Coarse gate generator
Commutated rectifier	Coarse phase detector
Relay	Coarse - fine relay
R-C network	Integration
Cathode follower	Isolation
Triode dc amplifier	
Triode dc amplifier	Series voltage dropping tube
Cathode coupled difference amplifier	Phase inverter and driver for servo motor control stage
Triode dc amplifier	Motor control tubes
Saturable reactor transformer	Motor control
R-C networks	Anti-oscillatory high frequency phase shift
Triode amplifier	Trigger amplifier
Blocking oscillator	
Pentode amplifier	Coincidence gate (control grid-suppressor grid coincidence)
Delay line	
Commutated rectifier	Phase detector
Diode connected triode	Peak detector for relay control
Triode amplifier	Relay control tube
Cathode coupled cathode follower summing circuit	Mixer for display circuit
2.3 Guidance Delay Unit	
Circuits of Guidance Delay Unit are identical with those of Range Delay Unit except that autosyns B102, and B103 in Range Delay Unit serve as synchro generators, whereas corresponding autosyns in Guidance Delay Unit function as control transformers.	
2.4 Release Unit	
Germanium diode	Detector circuit
Triode dc amplifier	Relay control circuit
Relay	Course - fine switch

Name of Circuit, Stage, or Part	Function, if not Described by Name
2.4 Release Unit (Cont'd)	
Transformer coupled audio frequency circuits	
Thyrite resistor	Voltage limiter
Triode amplifier	Autosyn amplifier
Cathode follower	Isolation
Commutated rectifier	Phase detector
Cathode coupled difference amplifier	Phase inverter and driver for motor control stage
R-C networks	Anti-oscillation phase shift networks
Triode dc amplifiers	Motor control tubes
Saturable reactor transformer	Motor control
Bridge circuit	Dc amplifier input balance
Transformer coupled audio frequency circuits	
Triode amplifiers	
Pentode amplifier	Coincidence tube (control grid, screen grid, suppressor grid coincidence)
Relay	Release switch
Rotary switch	Function selector
Servo motor	
Control transformer	
Gear train	
Veeder-Root counter	
2.5 Timer - Encoder	
Triode amplifier	Trigger amplifier
Blocking oscillator	Timer
Cathode follower	Isolation
Triode amplifier	Trigger amplifier
Delay line	Code generation
Germanium diode	Non-linear coupling device
Blocking oscillator	Code

Name of Circuit, Stage, or Part	Function, if not Described by Name
2.6 Modulator - Transmitter	
Thyratron switch tube	Pulse network discharge switch
Diode	Pulse network charging diode
Inductance	Pulse network charging inductance; provides "dc" resonance
Delay line	Line type pulse forming network used for magnetron modulation
Pulse transformer	Magnetron modulation
Diode	Clipper
Magnetron "S" band pulsed oscillator	
Spark gaps	Pulse-forming network protection
Diode	Full wave (hi-voltage, 3, 500v.) rectifier
L-C filters	Power supply filter
High voltage variac	
Relay, switch high voltage interlock circuit	
TR tube	
ATR tube	
Keep alive circuits	Keep alive voltage for TR tube
Waveguide elements	Duplexer
2.7 Receiver	
Slug tuned resonant cavity	Preselector cavity
Silicon diode mounted in resonant cavity	
Resonant decoupling filters	
Stagger tuned band pass if amplifier	
Klystron (integral cavity) oscillator	Local oscillator
Current metering circuit	Crystal current monitoring
Diode connected pentode	Detector
Pentode amplifier	Video amplifier
Cathode follower	Isolation

Name of Circuit, Stage, or Part	Function, if not Described by Name
2.7 Receiver (Cont'd)	
Pentode amplifier	Coincidence tube (control grid-suppressor grid coincidence)
Delay line	Decoder
Blocking oscillator	
Germanium diode	Clipping
2.8 Display Unit	
Display unit consists of oscilloscope and switching circuits.	
2.9 Power Supply	
Note: There are two power supplies, each essentially identical with the one described below.	
Rectifier	-100v, +300v, +150v, full wave rectifiers
L-C filter	Power supply filter
Beam power amplifier	-100v. series regulator tube
VR tube	Voltage reference
Triode amplifier	Regulator amplifier
Cathode coupled difference amplifier with positive feedback	Error sensing
Neon glow tubes	Dc coupling
Triode amplifier	+300v, and +150v series regulators
Switching circuits	Voltage monitoring
Power transformers	+300v, +150v, -100v supplies
Relay	Opens +300v primary if -100v dc supply voltage drops
2.10 Delay Unit Comparator	
Quartz crystal	Frequency control
Crystal controlled oscillator	80.85 kc signal (2 mile markers)
Shunting resistors	Blocking oscillator output damping
Triggered "frequency divider" blocking oscillator	10 mile marker generator
Crystal diode	Pulse mixing circuits
Crystal diode	Non-linear coupling device

Name of Circuit, Stage, or Part	Function, if not Described by Name
2.10 Delay Unit Comparator (Cont'd)	
Triggered "frequency divider" blocking oscillator	20 mile marker generator
Triggered "frequency divider" blocking oscillator	100 mile marker generator
Triggered "frequency divider" blocking oscillator	800 mile marker generator
Triggered "frequency divider" blocking oscillator	400 pps marker generator
Cathode follower	Isolation
Grounded grid overdriven dc amplifier	Pulse shaping (reduce rise time)
Triode amplifier	Amplifier
Triggered blocking oscillator	200 pps generator
Crystal diode	Voltage clamper
Cathode follower	Isolation
Crystal diode	Dc coupling
R-C network	Pulse stretching
Screen coupled phantastron	Saw-tooth generator
Cathode follower	Phantastron regeneration (Miller action)
Cathode follower	Isolation
Diode rectifier	Voltage limiter
Multiar circuit (biased limiter regeneratively coupled to amplifier)	Pulse generator
Cathode follower	Isolation and shift in voltage level

3. Monitor Station

3.1 Receiver

Receiver is dual channel; each channel has preselector, mixer, local oscillator, and if circuits which are identical with those in the Bi-Polar Beacon, see 2.7; in addition this receiver has the following:

Meter	Crystal current, bias voltage
Meter	"Left-Right" indicator (Director output)
Switching circuits	Meter switching, and Meter-Record (Director output switch)

Name of Circuit, Stage, or Part	Function, if not Described by Name

3.2 Decoder-Director

Monitor Station Decoder is identical with the Bi-Polar Guidance Set Decoder, see 1.3. Monitor Station Director is essentially identical with the Bi-Polar Guidance Set Director, see 1.5; in addition this Decoder-Director has the following:

Diode	Dc Restorer
Double-pole, double-throw switching circuits	"Direct-Delay" switch (in delay position guidance signals are fed to Delay Unit.)
Double-pole, double-throw switching circuits	"VTVM calibrate - delay calibrate" switch

3.3 Loss of Signal Indicator

Triode amplifier	
Triode amplifier	Relay control
Relay	Indicator control
R-C network	Pulse stretching
Indicator lamp	Release light
Neon indicator	Channel 1 and 2 indicator lights

3.4 Encoder

The Monitor Station Encoder is fairly similar in functioning, although not identical in circuitry, to the Bi-Polar Missile Guidance Set Encoder.

Triode amplifier	Trigger amplifier
Blocking oscillator	Pulse generation
Delay line (shorted)	Pulse reflection
Single triode paraphase amplifier	Generation of two signals 180° out of phase
Cathode follower	Isolation

3.5 Modulator-Transmitter

Identical with Modulator-Transmitter in Bi-Polar Beacon; see Regulus Bi-Polar Beacon, 2.6.

3.6 Delay Units

There are two Delay Units in the Monitor Station. Each is identical with the Delay Unit in the Bi-Polar Beacon, see Regulus Bi-Polar Beacon, 2.1

Name of Circuit, Stage, or Part	Function, if not Described by Name
3.7 Recorder	
The output of the Monitor Station Director is fed either to a center reading galvanometer, or to an Esterline - Angus tape recorder.	
3.8 Power Supply	
The Monitoring Station Power Supply is identical with the Power Supply in the Regulus Bi-Polar Beacon, see 2.9.	
3.9 Voltage Regulator Unit	
VR tubes	Repeller voltage regulation
R-C networks	Voltage dropping and filtering
4. Regulus Guidance Set Special Test Equipment	
4.1 Test Pulse Generator	
Blocking oscillator	Pulse generator
Cathode follower	Isolation
Cathode coupled monostable multivibrator	
Triode amplifier	Isolation, paraphase amplifier
Triode amplifier	Trigger amplifier
Half wave rectifier	Bias rectifier
R-C network	Bias supply filter
Full wave rectifier	Plate supply rectifier
Germanium diode	Clipping
Power transformer	
L-C network	Plate supply filter
4.2 Test Encoder	
Triode amplifier	Trigger amplifier
Blocking oscillator	Pulse generator
Triode amplifier	Paraphase amplifier
Cathode follower	Isolation, mixing (in cathode circuit)
Delay line (shorted)	Pulse reflection
Half wave rectifier	Negative supply rectifier
R-C network	Negative supply filter
Full wave rectifier	Plate supply rectifier
Power transformer	

Name of Circuit, Stage, or Part	Function, if not Described by Name
4.3 Transmitter Output Monitor	
Stub supported, 50 ohm S band coaxial elbow	
Lighthouse diode	Detector
4.4 Crystal Detector	
Silicon diode	Detector for local oscillator allignment
4.5 Rf Test Load	
Coaxial dry (coated sand filling) load	
Radio Command Guidance	
5. Regulus Guidance Set	
5.1 Radio Receiving Set AN/ARW-59(XN-2)	
Pentode amplifier	Rf pre-amplifier
Xtal oscillator	1st if oscillator
Triode rf amplifier	Doubler (frequency)
Pentode rf amplifier	Frequency trippler
Pentode mixer	1st if mixer
If amplifiers	Turnable if's
Xtal oscillator	2nd if oscillator
If amplifiers	2nd if amplifiers capacity coupled-double tuned
Pentode mixer	2nd if mixer
FM limiter	
Foster-Seely discriminator	
Cathode follower	Audio output
Relay amplifier	Squelch amplifier
Relay tube	Squelch tube
Diode rectifier	AVC diode
5.2 Radio Command Decoder KY117(XN-2)DRW	
Triode video amplifiers	
L-C filters	Band pass filters

Name of Circuit, Stage, or Part	Function, if not Described by Name
5.2 Radio Command Decoder KY117(XN-2)DRW (Cont'd)	
Triode amplifier	Beep demodulator
Crystal diode	Beep demodulator
Relay tube	Beep demodulator
Cathode follower	Input magnetic modulator
Cathode follower	Followup potentiometer amplifier
Magnetic modulator	400 cps magnetic amplifier
Servo amplifier	Push-Pull triodes
Control synchros	400 cps - 2 phase
Video triode amplifier	Proportional demodulator
Cathode follower	Proportional demodulator
Diode	Demodulator
Triode amplifier	Dc amplifier
Crystal diode	Biasing rectifier
Neon bulb	Coupling tube
R-C filter	Demodulator filter
Grid limiter	Triode amplifier
Diode limiter	Clipper diodes
Cathode follower	Impedance transformer
Dc triode amplifier	Squelch relay amplifier
R-C filter	Pi integrating network
Dc triode amplifier	Squelch relay tube
5.3 Throttle Servo Amplifier	
Triode amplifier with grid mixing	
Diode rectifier	Power supply
Modulator control tube	Current control
Modulator transformer	4 winding
5.4 Throttle Servo	
Two phase servo motor	Throttle servo
Synchro generator	Rate generator
Synchro generator	Position pick-off

Name of Circuit, Stage, or Part	Function, if not Described by Name
Trounce Guidance	
6. KY-74/DPW Trounce Decoder	
Triode trigger amplifier	
Blocking oscillator	
Delay line	100 micro seconds tapped
Relay line	
Blocking oscillator	
Coincidence tubes	Demodulators
PRF discriminators	
Relay tubes	
7. APN-334 Trounce Transponder	
Magnetron	Radar transmitter
Klystron	Local oscillator
Triode	Magnetron pulser
Crystal mixer	
Voltage indicator tube	
Triode blocking oscillator	Pulse gate tube
VR tubes	Voltage regulators
Pentode if amplifiers	Shunt peaked
Diode detector	
Pentode video amplifiers	
Triode cathode followers	
28v dynamotor	

SPARROW

Name of Circuit, Stage, or Part	Function, if not Described by Name
1. Tail Section	
Crystal detector	
Antenna assembly	Open end waveguide type
TR tube	Rf switch
Heater, crystal	Electrical heater strip
Thermostat, crystal heater	Series connected to heater
Rectifier, dc isolating circuit	Keep alive voltage isolator
Cathode follower	Pre-amplifier, impedance transformer
2. Battery Unit	
Battery box	Prime electric power supply
Inverter	Synchronous vibrator
Buffer capacitor	Vibrator buffer
Series voltage regulator tubes	Plate supply regulator
VR tubes	Voltage reference
Dc amplifiers	Regulation control tube
Stepping relay	Internal-External power switching
3. Accumulator Unit	
Hydraulic accumulator	
Heater, hydraulic accumulator	
Thermostat, hydraulic accumulator heater	
4. Hub Section Assembly	
Valve stroker	Differential solenoid
Control valves, hydraulic	Wing actuator controls
Wing actuators	Servo hydraulic cylinders
Heater, valves	Electrical strip heater
Thermostat, valve heater	Series connected to heater
Arming delay mechanism	Mechanical inertia-hydraulic

Name of Circuit, Stage, or Part	Function, if not described by Name
5. Rectifier Unit	
Transformer, vibrator step up	
Rectifiers	Power supply rectifiers
Filter sections	Power supply filter
Heater	Rectifier heating strip
Thermostat	In series with heater
Thyratron timer	Auto-pilot timer
6. Rate Gyro Unit	
Rate Gyros	Yaw, pitch and rate gyros
Heater	Gyro strip heaters
Thermostat	Gyro heaters series thermostat
Summing resistor network	Resolver
Cathode follower	Summing amplifier (resolver)
Triode amplifier	Phase investing amplifier (resolver)
Tuning capacitor	Gyro pick-off tuning
7. Free Gyro Unit	
Free Gyro	Roll, pitch and yaw gyros
Solenoids	Gyro uncaging solenoids
Resolver transformer	Gyro pick-off synchro
Tuning capacitors	Resolver tuning capacitors
8. Servo Amplifier Unit	
Phase inverters	Paraphase type inverter
Demodulators	Ring diode demodulators
Cathode followers	Impedance transformers
L-C filter	2500 cps filter
Dc push-pull power amplifier	Servo amplifier
Tuned plate push-pull oscillator	Dither oscillator
Rectifier	Amplitude control voltage rectifier
Clamper diode	

Name of Circuit, Stage, or Part	Function, if not Described by Name
9. Summing Amplifier Unit	
Cathode follower	Negative signal limiter
Grounded grid amplifier	Positive signal limiter
Resistor summing networks	
Af amplifier	Summing amplifiers
Series regulator tubes	Voltage regulator
L-C filter	Supply voltage filter
Af amplifier	Output amplifier
Feedback network	R-C coupling network
L-C filter	Gain control pressure gauge signal filter
Accelerometers inductive bridge arrangment	Senses displacement rate from flight path
Step relay	Operation changeover relay
Thermostat	Series contact heating thermostat
Heaters	Electric strip heaters
10. Guidance Amplifier Unit	
L-C filter	50 cps filter (input)
Lag networks	R-C networks
Lead amplifier	Af push-pull amplifier
Cathode followers	Filter isolating amplifiers
Modulator	Balanced push-pull w/carrier suppression
Buffer amplifier	Push-pull feedback amplifier
Oscillator	2500 cps push-pull tuned plate
Potentiometer	Channel gain adjust
Summing network	Command detonation
Trigger thyratron	Command detonation
11. Guidance Receiver	
Video amplifier	Conventional
Video amplifier	Feedback amplifier
Shunt peaking circuits	Video amplifier peakers

Name of Circuit, Stage, or Part	Function, if not Described by Name
11. Guidance Receiver (Cont'd)	
Diode	Video amplifier grid circuits shunt
Cathode followers	Video output
Cathode follower	MCV amplifier
Delay lines	Decoder coincidence ckt
Coincidence tubes	Decoder coincidence ckt
Cathode followers pulse stretcher	Impedance transformers pulse stretcher
L-C filter	50 cps video output filter
Potentiometer	Coincidence tube plate bias adjust
Testing and Servicing Equipment	
12. Microwave Test Console	
12.1 Rf head and microwave unit	
Klystron oscillator	Microwave test generator
Modulator	Ferrite rod modulator
Impedance transformer	Matching stub
Waveguide attenuators	Standard vane type
Directional couplers	Waveguide couplers
Frequency meter	Coaxial absorption type
Crystal detector	Modulation monitor
Bead thermistor	
12.2 Wattmeter Bridge	
Wien bridge oscillator	R-C bridge
Amplifier	Wein bridge oscillator amplifier
Cathode follower	Impedance transformer
Amplifier	VTVM
Bridge rectifier	Crystal meter rectifier
R-C filter	100kc filter twin T
Disc thermistor	Temperature compensation
Oscillator (100kc)	TPTG crystal oscillator

Name of Circuit, Stage, or Part	Function, if not Described by Name
12.2 Wattmeter Bridge (Cont'd)	
Cathode follower	Impedance transformer buffer
Attenuator	Range selector VTVM
Power transformer	Power supply
Power rectifier	Full wave hard diode
RL filter	Power filter (60 cps)
Series regulator tubes	Voltage regulator
Dc amplifier	VR control amplifier
Voltage reference tube	Voltage regulator
Potentiometers	Meter sensitivity
Potentiometers	VTVM feedback potentiometers
Potentiometers	VR ckt volts adjust
Potentiometers	100kc calibrate
12.3 Modulation Monitor	
Video amplifiers	
Cathode follower	Impedance transformer
Delay line	1 usec.
Pulse stretcher ckt	Crystal, R-C network
Cathode follower	Impedance transformer
Video amplifier	
Blocking oscillator	Detector gate
Staircase detector	
Bias R-C network	Detector bias
Attenuator	VTVM range selector
Af amplifiers	VTVM amplifiers
Rectifier bridge	VTVM crystal meter bridge
R-C filter	Band rejection filter (50 cps) twin t filter with phase modification
Bias delay circuit	AGC delay circuit
Cathode follower	Impedance transformer
Potentiometers	Various

Name of Circuit, Stage, or Part	Function, if not Described by Name
12.4 Video Power Supply	
Full wave rectifier	-300 volt supply source
Full wave rectifier	+300 volt supply source
L-C filter	Power supply filter
Voltage reference tube	+300 volt supply reference
Voltage reference tube	-300 volt supply reference
Voltage reference tube	+150 volt supply reference
Dc amplifiers	Regulator control amplifier
Series regulator tubes	
Potentiometers	Output voltage adjust
12.5 Klystron Power Supply	
Full wave rectifier	Beam supply
Full wave rectifier	Reflector supply
L-C filter	Power supply pi filter
Voltage reference tubes	
Dc amplifiers	Regulator control amplifiers
Cathode followers	Regulator control amplifiers
Series regulator tubes	
Diode clipper	Unblocking diode
Potentiometers	Output voltage adjust
12.6 Meter Panel Assembly	
13. Video Control Console	
13.1 2500 cps Reference Amplifier	
Potentiometers	Gain set
Potentiometers	Load potentiometers
Potentiometers	Output level set
Af voltage amplifier	Push-pull voltage amplifier
Af power amplifier	Push-pull power amplifier
Potentiometers	Feedback adjust potentiometers

Name of Circuit, Stage, or Part	Function, if not Described by Name
13.2 Power Supply #1	
Full wave rectifier	Power rectifier
L-C filter	Pi power supply filter
Reference tube	
Series regulator tubes	
Dc amplifier	Regulator control amplifier
Potentiometer	Voltage output set
Power relay	
13.3 Meter Panel Assembly	
13.4 Video Meter Unit Assembly	
General radio model 1800A VTVM	
13.5 Video Switching Unit Assembly	
13.6 Oscillator Unit Assembly	
Hewlitt-Packard 202A oscillator	
13.7 Hydraulic Control Panel	
14. Recorder Console	
14.1 Demodulator Unit	
Af voltage amplifier	Single ended
Cathode follower	Impedance transformer
Discriminator	Phase, amplitude demodulator
Potentiometers	Zero set control
R-C filter	Output smoothing filter
14.2 Sanborn Model 67-1200 Four Channel Recorder	
14.3 Sanborn Model 67-1600 Control Panel	
14.4 Sanborn Model 67-300 Dc Amplifier	
15. System Test Console	
15.1 Power Supply-Switching Unit	
Af voltage amplifiers	Ripple amplifiers

Name of Circuit, Stage, or Part	Function, if not Described by Name
15.1 Power Supply-Switching Unit (Cont'd)	
Crystal diode	Meter rectifiers
Potentiometer	Calibration set potentiometer
Relays	Power switching
Relays	Time delay
15.2 Power Supply #2	
Full wave rectifier	Power rectifier
L-C filter	Pi power supply filter
Reference tube	
Series regulator tube	
Dc amplifier	Regulator control amplifier
Potentiometer	Output voltage set
Power relay	
15.3 Power Supply #3	
Power relay	
Bridge rectifier	Power dry disk type
Auto transformer	Voltage input adjust
L-C filter	Choke input power
15.4 Arming and Firing Test Unit (Air)	
15.5 Power Supply Switching Unit	
15.6 Line Regulator Unit	
Sorenson model 3000S voltage regulator	
15.7 Meter Panel Assembly	
16. Video Test Conscle	
16.1 Quadrant Dual Pulse Generator Power Supply	
Full wave rectifier	Power rectifier
L-C filter	Pi power filter
Series regulator tubes	
Reference tubes	

Name of Circuit, Stage, or Part	Function, if not Described by Name
16.1 Quadrant Dual Pulse Generator Power Supply (Cont'd)	
Dc amplifiers	Regulator control amplifiers
Cathode follower	Regulator control amplifier
Potentiometer	Voltage adjust potentiometer
Power relay	
16.2 Video Attenuator Assembly	
Dry disc rectifiers	Isolating diodes
Relay	Inst. switching relays
16.3 Quadrant Dual Pulse Generator	
Oscillator	2200 cps sine wave tuned plate push-pull
Pulse height discriminator	Pulse generator
Pulse shaping amplifier	
Negative pulse blonching amplifier	
Pulse gate	
Multivibrator	Scale of ten counters
Multivibrator	Delay multivibrator
Thyratron	Tracking pulse generator
Coincidence tube	Dual pulse trigger
Multivibrator	Scale of four counters
Multivibrator	Gating tube
Thyratron	Trigger pulse forming tube
Coincidence tube	Pulse selector
Thyratron	Tracking pulse switch
Thyratron	Guidance pulse switch
Delay lines	Pulse forming lines
Modulator tubes	Series regulators
Limiter	Diode clipper
Cathode follower	Impedance transformer
Filter network	50 cps bond pass
Phase inverter	Single ended

Name of Circuit, Stage, or Part	Function, if not Described by Name
16.3 Quadrant Dual Pulse Generator (Cont'd)	
Cathode follower	Push-pull transformer corrected
Phase resolver	
Paraphase amplifier	
Cathode follower	Impedance transformer
Limiter	Negative clipping stage
VR tube	
Af amplifier	
16.4 Meter Panel Assembly	
16.5 Pre-Amplifier Unit	
Tektronix type 121 pre-amplifier	
16.6 Video Scope Unit	
Tektronix model 514D oscilloscope	
17. Servo Test Console	
17.1 Power Supply #4	
Full wave rectifier	Power rectifiers
Reference tube	
L-C filter	Pi power filter
Series regulator tubes	
Dc amplifier	Regulator control amplifier
Potentiometers	Voltage output set
Potentiometers	Regulating range set
17.2 Meter Panel Assembly	
Voltage amplifier	Ac VTVM amplifier
Cathode follower	Impedance transformer
Potentiometer	Feedback res. and zero set
17.3 VTVM Unit	
Ballantine model 300 VTVM	
17.4 Servo Scope Unit	
Dumont type 304hr oscilloscope	

Name of Circuit, Stage, or Part	Function, if not Described by Name
17.5 Servo Switching Unit	
17.6 Monitoring Unit	
17.7 Filament Supply	
Sorenson Nobatron E-7-43	
18. Hydraulic Console	
18.1 Mechanical Equipment	
Air pump	Sliding vane positive displacement
Air pump motor	220v 3 phase ac
Pump discharge air filter	Two stage condensing
Oil pump	Reciprocating piston
Oil pump motor	220v 3 phase ac
Solenoid hydraulic valves	Routing valves
Solenoid valve	Cooling water control
19. Rf and Video Console	
19.1 Power Supply (B+ and B-)	
Full wave rectifier	Power rectifiers
L-C filter	
Series regulator tubes	
Dc amplifiers	Series connected voltage control
19.2 Video Attenuator Panel (Weston Model 769 Electronic Analyzer VTVM)	
19.3 VTVM Panel (General Radio Type 1800A VTVM)	
19.4 Output Meter Panel	
19.5 AGC Bias Supply Battery Pack	
20. Component Power Supply Test Console	
20.1 Autopilot Timer Tester	
Full wave rectifier	Power supply
Synchronous timer	Step clock type

Name of Circuit, Stage, or Part	Function, if not Described by Name
20.1 Autopilot Timer Tester (Cont'd)	
Thyratron timer	Delay timer
Voltage regulator	VR tube string
L-C filter	Power supply pi filter
20.2 Rectifier Unit Tester	
Full wave rectifier	Dry disc power
20.3 Battery Unit Assembly Tester	
Bridge rectifier	Dry disc meter rectifier
20.4 Regulator Assembly Tester	
Full wave rectifier	Power rectifier
L-C filter	Power supply pi filter
Voltage reference tube	VR tube
Dc amplifier	Regulator control tube
20.5 Hi-Potential Tester	
Half wave rectifier	Power supply
R-C filter	Power supply filter
Thyratron trigger	Reject relay switch
20.6 Power Supply Panel	
Bridge rectifier	Dry disc power supply
L-C filter	Choke input power supply
21. Activated Battery Box Tester	
Half wave rectifier	Power supply
Full wave rectifier	Power supply
L-C filter	Power supply pi filter
RL filter	Power supply pi filter
Voltage regulator	VR tube
Voltage reference tube	VR tube
Series regulator tube	
Dc amplifier	Regulator control
Synchronous timer	

Name of Circuit, Stage, or Part	Function, if not Described by Name
21. Activated Battery Box Tester (Cont'd)	
Vibrator	Dc chopper inverter
Af amplifier	
Demodulator	Diode
Dc power amplifier	
R-C filter	Af filter
22. Hydraulic Test Bench	
22.1 Power Supply	
Full wave rectifier	Dc power supply
RL filter	Power supply pi filter
Series regulator	
Dc amplifier	Regulated power supply control
VR tubes	Voltage reference
22.2 Signal Synthesizer Amplifier Rack	
Phase inverter	Dc summing amplifiers
Cathode follower	Impedance transformer
Demodulators	Diode
Servo amplifiers	Push-pull dc amplifiers
22.3 2500 cps and Dither Oscillator Rack	
Oscillator	210 cps tuned plate
Diode clipper	Diode oscillator output regulator
Oscillator	2500 cps push-pull tuned plate
22.4 Stroker Test Box	
Full wave rectifier	Dc power supply
R-C filter	Dc power supply pi filter
Voltage regulator	VR tube
22.5 Actuator Test Console	
Industrial control co dynamic analyzer model 100A spec 15A	
Ballantine model 300 VTVM	
Dumont type 304H oscilloscope	

Name of Circuit, Stage, or Part	Function, if not Described by Name
22.6 Hydraulic Pump and Base Assembly	
22.7 Arming Delay Tester	
22.8 Potentiometer Zeroing Indicator	
23. Gyro Test Console	
23.1 Gage Amplifier	
Strain gage bridge	Ac bridge with resistor and phase balancing networks
Triode af amplifier	Pre-amplifier
Summing amplifier	Triode amplifier
Demodulator	Diode push-pull
Dc amplifiers	Triode push-pull, feedback
Dc amplifiers	Pentode push-pull cathode followers
Full wave rectifiers	Dry disc power supply
R-C filter	Power supply
Voltage regulator	VR tubes
Af oscillator	Push-pull tuned plate
23.2 Sine Drive Assembly	
Graham drive	
Resolver transformer	
23.3 Power Supply	
Full wave rectifier	Power supply
Half wave rectifier	Power supply
L-C filter	Power supply
R-C filter	Power supply
VR tube	Voltage regulator
VR tube	Voltage reference
Pentode dc amplifier	Regulated supply control
Triode cathode follower	Regulated supply control
Series regulator	Regulated power supply

Name of Circuit, Stage, or Part	Function, if not Described by Name
23.4 Meter Panel	
23.5 Free Gyro Control Panel	
23.6 Control Panel	
23.7 Rate Gyro Unit Test Assembly	
Pendulum test fixture	
Unit test selector	
23.8 Sine Drive Assembly	
23.9 Rate Gyro/Accelerometer Calibrator Test Panel	
24. Summing Amplifier Test Console	
24.1 Summing Amplifier Tester	
Triode cathode follower	
VR tubes	Voltage regulator
Af oscillator	Tuned plate push-pull
24.2 Power Supply	
Full wave rectifier	Power supply
L-C filter	Power supply
VR tube	Voltage reference
VR tube	Voltage regulator
Dc amplifier	Regulator control amplifier
Series regulator tubes	Regulated power supply
24.3 Filter Panel	
R-L-C filter	Power supply filter and transient suppressor
24.4 Meter Panel	
Simpson model 260 multimeter	
Ballantine model 300 VTVM	
24.5 Sorenson dc Power Supply Model 500 BB	

Name of Circuit, Stage, or Part	Function, if not Described by Name
25. Guidance Amplifier Test Console	
25.1 Guidance Amplifier Tester	
Tapped voltage divider	Voltage calibrator
Phase inverter	Paraphase, feedback amplifier
Cathode follower	Impedance transformer
Dc amplifier	Phase inverter output level controller
Dc amplifier	Phase inverter output level adjustment
Diode rectifier	Commutated demodulator
Af oscillator	Push-pull tuned plate
Cathode follower	VTVM
Diode rectifier	Half wave demodulator
R-C filter	Af demodulator output
L-C filter	Af demodulator output
25.2 Difference Current Amplifier	
Cathode followers	Push-pull triodes
Phase inverter	Paraphase feedback amplifier
Dc amplifier	Phase inverter output level control
Dc amplifier	Phase inverter output level adjust
25.3 Power Supply	
Full wave rectifier	Power supply
L-C filter	Power supply
Series regulator	Regulated power supply
VR tubes	Voltage reference
Dc amplifier	Regulated supply control
25.4 Meter Panel	
Simpson model 260 multimeter	
Ballantine model 300 VTVM	

Name of Circuit, Stage, or Part	Function, if not Described by Name
26. Servo Amplifier Test Console	
26.1 Servo Amplifier Tester	
Af oscillator	Push-pull tuned plate
26.2 Power Supply	
Full wave rectifier	Power supply
L-C filter	Power supply
Series regulator tubes	Regulated power supply
VR tube	Voltage reference
Dc amplifier	Regulated power supply control
26.3 Tester Power Supply	
Full wave rectifier	Power supply
L-C filter	Power supply
Series regulator tubes	Regulated power supply
VR tube	Voltage reference
Dc amplifier	Regulated power supply control
26.4 Meter Panel	
Simpson model 260 multimeter	
General radio, type 1800A VTVM	
27. Instrument Stand	
27.1 Switching Panel	
27.2 Millivac Type MV-73B Multimeter	
27.3 Ballantine ac Model 300 VTVM	
28. Guidance Receiver Oscilloscope Unit	
28.1 Tektronix Type 514D Oscilloscope	
28.2 Tektronix Type 121 Pre-Amplifier	

PETREL

Name of Circuit, Stage, or Part	Function, if not Described by Name
1. Power Supplies	
1.1 Positive Supplies	
+300 volts supply	
Series regulator dc amplifier	(Cascade triode)
+150 volts supply series regulator dc amplifier	(Pentode)
+160 volt supply	
1.2 Negative Supplies	
Series regulated supplies with triode dc amplifiers	Fundamentally same as positive supplies except for grounding
Series regulated supply with pentode dc amplifiers	
Unregulated supply	Diode connected triodes
2. Transmitter and Receiver Rf Sections	
Tunable magnetron	Generate rf pulse
Wave guide plumbing	Transport rf and mix rf
ATR tubes	Rf switches
Full wave rectifier supply	
High voltage pulser	
Klystron	Local oscillator
3. AFC Unit	
Broad band if amplifiers	
Discriminator	
Af amplifier	Pentode
Phantastron	Develops klystron repeller voltage
4. If Amplifier	
Cascode input stage	Pentode and grounded grid triode
If amplifier stages	Pentodes w/AGC
Detector	Diode connected triode
Cathode follower	

Name of Circuit, Stage, or Part	Function, if not Described by Name
5. Range Unit	
Phase shift oscillator	Provides repetition rate
Blocking oscillator – grid plate coupled via transformer	Trigger generator
Cathode follower	Impedance transformer
Diode clipper	Clips negative peaks from input signal to amplifier
Multivibrator, cathode driven, one shot	Gates saw tooth generator
Saw tooth generator, "boot-strap"	Saw tooth voltage for range data
Comparator, grid-cathode	Compares range voltage and echo reference voltage, drives differentiator; compares range pulse and selector gate pulse to drive relay
Differentiator	Triode amplifier to increase pulse sharpness
Gate generators, thyratron	Gas tube amplifiers
Tank circuit, passive resonant circuits	Produce an output voltage when excited at their resonant frequency
Clipper amplifier, R-C duo triode amplifier	Drives range comparator from tank
Mechanical relay's switches	
6. Yaw Unit	
Bi-stable multivibrator with trigger diodes	Triggered by trailing edge of range saw tooth
Pulse amplifier, triodes	Amplify multivibrator output
Multivibrator, gated, grid plate coupled	Switch tube pulse generators
Video amplifier, two stage w/cathode follower	Echo pulse amplifier
Cathode follower	Impedance transformer
Suppressor modulated mixer	Mixes two pulses
Gas thyratron pulse generator	Early and late gate generators
Commutated rectifier	Switch
Dc amplifier, triode	AGC amplifiers
Relays	Switches

Name of Circuit, Stage, or Part	Function, if not Described by Name
7. Antenna Stabilization	
Antenna gyro	Deflected to port or starboard by unbalanced echo signals; deflected up or down by pitch errors
Vertical gyro	Primary vertical reference
Antenna drive motors	Position antenna in response to antenna
Antenna feedback potentiometers	Servo amplifiers
Antenna servo amplifier phase inverter	
Push-pull dc amplifiers	
Magnetic amplifiers (potted)	
8. Auto Pilot	
Lateral computer	
Yaw amplifier	Pentode dc amplifier; limiter
Lateral control amplifier	Two identical halves, starboard and port, only starboard listed; pentode dc amplifier with passive grid input mixing; cathode follower output
Final amplifier	Two identical halves, starboard and port, only starboard listed
Input stage	Triode dc push-pull amplifier
Output stage	Relay control tubes (pentode)
Longitudinal computer	
Pitch limiter	Diode limiter
Altitude relay circuit	Inverter, cathode coupled; relay control tube, triode
Vertical amplifier	Similar to yaw amplifier
Longitudinal control amplifier	Similar to half of lateral control amplifier
9. Control Surface Actuators	
Three phase electrical motor	Provides mechanical motion for moving control surfaces

Name of Circuit, Stage, or Part	Function, if not Described by Name
9. Control Surface Actuators (Cont'd)	
Electromagnetic clutches	When actuated by auto pilot control direction of shaft rotation and home direction of control surface motion
Reducing gears, spiraled shafts, etc.	Serve to couple motors, clutches, and control surfaces
Microswitches on clutches	Provide electrical cut off at mechanical limits
Follow up potentiometers	Positioned by control surfaces, they provide feedback data to follow up voltage and position data to telemeter
Microswitches on follow up potentiometers	Provide for interlock in test sequences initiated just prior to missile launching
Control Monitor Group	
10. Pulse Generator	
Commutated diode switch	Mixer tube
Diode commutator	Clamp tube
Astable multivibrator	
R-C triode amplifier	Limiter
Cathode coupled monostable multivibrator	Delay multivibrator
Differentiating triode amplifier	
Thyratron switches	Trigger generators
11. Power Supply PP 505	
Unit contains regulated dc supplies following rectifiers operating from a 3 phase 115v 400 cps line. Vacuum tube series regulators and shunt regulators are used. (Circuit diagram not available.)	
12. Control Indicator Assembly	
Electrically driven potentiometer with manual over-ride	Constant speed motor
Unit also contains one manual switch, 2 lamps, and a few fixed resistors	

Name of Circuit, Stage, or Part	Function, if not Described by Name
13. High Voltage Power Supply	
Rf power supply, full wave rectification	
14. Control Monitor Group Unit	
Dual gun CRT	CRT with usual focusing and centering controls
Plug in timers	
Miscellaneous relays, pilot lamps, switches, potentiometers	
15. Fine Range Unit	
Cathode coupled monostable multivibrator	
Suppressor modulated gate tube	Coincidence tube
Diode clamps	
Cathode follower	
Triode amplifier	Fuel range control tube
16. Target Presentation Unit	
Cathode coupled monostable multivibrator	"A" sweep multivibrator
Boot strap saw tooth generator	"A" sweep generator
Triode amplifier	Phase inverter
Diode clamps	
Pentode video amplifier	
Triode video amplifier	
Cathode follower	
17. Engine Control Unit	
Clipping amplifier, triode	
Diode clipper and R-C differentiator	
Dc amplifiers, triode	
Relay control tubes, triode	
Integrating circuits	

Name of Circuit, Stage, or Part	Function, if not Described by Name

18. Tube Tester TU-7/U

A standard commercial Hickok tube tester

19. Detonator Test Set

Essentially an ohmmeter

20. Inverter Box

Contains motor alternater inverters, ammeters, voltmeters, switches and fuses used to convert 28v dc into 400 cycle, 3 phase, 115v ac

21. Magnetron Test Unit

Regulated power supply (gas tube shunt regulator)

Phase shift oscillator

Blocking oscillator

Clipper diode

Thyratron pulse amplifier

High voltage supply

Timing relays

Variac

Panel meters

22. Missile External Load Box

Unit consists of plugs, connectors, fuses, relays and resisters used to load missile alternator systems

23. Generator Adjusting Device

Essentially a special purpose hand tool

24. Multimeter - TS - 352A/U

A standard commercial Weston multimeter

25. Crystal Test Set TS - 268D

A standard unit for measuring forward and reverse characteristics of crystal rectifiers

Name of Circuit, Stage, or Part	Function, if not Described by Name
26. Ac Dc VTVM (ME-25/V)	
A standard commercial instrument	
27. Autopilot Test Set	
Shunt regulated power supply	
Micro ammeter	
Unit also includes plugs and switches	
28. Servo Amplifier Test Adapter	
Consists of a shorting plug set with switch	
29. Monitor Test Unit (For testing control monitor group)	
In addition to plugs, switches, indicating lamps and relays, unit contains:	
Frequency meter	
Voltmeter ac	0-150v
Regulated dc-supply	(150u) (shunt glow tube)
Regulated dc-supply	(300v) (series vacuum tube)
Magnetic tachometer	
Voltmeter dc	150-0-150v
Grid controlled rectifier, motor driven tachnometer in servo loop	
Crystal controlled oscillator	
Blocking oscillator	
Blocking oscillator frequency devices	
Cathode follower	
Triode amplifier and differentiator	
Diode switches	
Cathode coupled multivibrator with delay voltage	
Suppressor modulated gate amplifier	Coincidence tube

Name of Circuit, Stage, or Part	Function, if not Described by Name

29. Monitor Test Unit (For testing control monitor group) (Cont'd)

Thyratron pulse amplifier

Triode amplifier, clipper

Diode clipper

30. Monitor Adaptor Unit

In addition to plugs, terminals, switches, also contains:

Temperature indicating meter (ohmmeter)

Voltmeters (panel meter)

Timer relay

31. Remote Meter Box

Contains pilot lights, selector switches and two D'Arsonval current meters

32. Power Distribution and Control Panel

Junction box with plugs, terminals, fuses, switches and 0-150v ac meter

33. Signal Generator (AN/URM-43)

A standard rf, if generator, wattmeter, frequency meter

34. Oscilloscope (256-D)

A standard synchroscope

35. Control Monitor Group Unit

See 14., Control Monitor Group Unit for use with missile; this is the same equipment

36. Monitor Power Unit

See 11., power supply PP 505 in the Control Monitor Group for use with missile; this is the same equipment

Name of Circuit, Stage, or Part	Function, if not Described by Name
37. Spectrum Analyzer (TS-148/UP)	
A standard piece of test equipment	
38. Tuned Cavity	
Consists of a manually tuned resonant cavity, a crystal rectifier, and a micro ammeter	

DOVE

Name of Circuit, Stage, or Part	Function, if not Described by Name
1. Nose Assembly	
1.1 Hard Tube Timer	
Relay	Control "A" out
Relay	Control "C" out
Triode vacuum tubes	Voltage stabilizers
Triode vacuum tubes	Relay control
1.2 Voltage Regulator	
Series tubes	Controls dc output
Dc control amplifier	Controls series tubes
Gas diode	Voltage reference
Relay	Auxiliary time delay (end of gyro "rev-up")
1.3 Oscillator Power Supply	
Series tube	Control dc voltage
Dc amplifier tube	Controls series tube
Voltage reference tube	Supplies reference voltage
Blocking oscillator	Supplies 350v PP at 500 cps
Selenium rectifiers	Voltage doublers
Filter package	Supplies filtered + and - 120 volts
1.4 Eye Gyro Drive Relay	
Relay	Energizes magnetic clutch and eye gyro drive motor fan "A" timer; and applies voltage to one side of ATDR
1.5 Nozzle Assembly	
Thermistor assembly	Incoming radiation detector
Nozzle amplifier and ring assembly	Input pre-amplifier
Triode pre-amplifiers	
Shell assembly	

Name of Circuit, Stage, or Part	Function, if not Described by Name
1.5 Nozzle Assembly (Cont'd)	
Protector cap assembly	
Lead assembly	Small copper tubing shielded leads
Bypass condenser assembly with ballast resistor	
Filter choke assembly	Drop +31.5 volts to 6.3 filtered
1.6 Signal Amplifier	
Noise cancelling amplifier	Cancels input noise
AGC controlled amplifiers	Amplify signal
Triode amplifiers	Amplify signal
Phase inverters	Provide signals 180° out of phase
Signal rectifier	Cathode follower action gives positive output pulses on positive halves of input signal
Cascode tubes (anode supply)	Supplies 150 volt dc
Series tube	Controls 270 volts
Dc amplifier tube	Controls series tube
Series tubes	Control 180 volts
Dc amplifier tube	Controls series tubes
Voltage reference tube	Provides reference voltage
Series tube	Controls 90 volts
Ac amplifier tube	Controls series tube
AGC	Supplies AGC voltages
1.7 Torque Motor Drive	
Pulse discriminator diodes	Accept 9.5 volt positive signals
Pulse discriminator amplifiers	Amplify signal to 210-220v
Thyratron triggers	Gating circuits
Gating, one-shots	Control torque motor trigger tubes
One-shot multivibrators	Control torque motor trigger tubes
Torque motor, one-shot trigger tubes	Control torque motor one-shot multivibrators
One-shot multivibrators	Torque motor one-shot multivibrators
Relays	Energize torque motors
Relays	Jettison control; uncage control

Name of Circuit, Stage, or Part	Function, if not Described by Name
1.8 Computer	
Pulse shappers	Shape input pulses
E-J counters	3 stage binary counters
Back count triggers	Add 7 counts for each right signal
Differential detectors	Energizes counter relay for an excess of 3 counts in one direction over the opposite direction
Deflector one shot multivibrators	Engerizes relays to activate pneumatic acting solenoid
Relays	Trigger deflector one shot multivibrators
Relays	Trigger pneumatic acting solenoids
1.9 Nose Breakaway Switch	
Normally closed micro switch	Mounted on high pressure pneumatic assembly. Contacts close at breakaway

1.10 Actuator Valve Assembly (Solenoid)

Provides 2 way gas control mechanism, delivering gas at 225 and 150 psi to pistons of deflectors and piston for roll control respectively

Solenoid assembly

Valve body

Piston and plunger assembly

Return spring

Valve piston

Valve sleeve

Plunger stop

Compensating spacer

End cap

Mounting block

1.11 High Pressure Pneumatic Assembly

Supplies and regulates dry nitrogen gas to the nose pneumatic system 225 psi

Gas bottle - 34 cubic inches

Regulator body

Name of Circuit, Stage, or Part	Function, if not Described by Name
1.11 High Pressure Pneumatic Assembly	(Cont'd)
Arming valve plug	
Diaphragm	
Thrust pin stem	
Seat	
Spring	
Adjusting spring	
Set screw	
"O" ring	
Charging valve body assembly	
Release valve lever assembly	
"O" ring	
Nose breakaway switch	
1.12 Pneumatic Actuator Drive	
Used to extend and retract deflectors which control the flight path	
Actuator body	
Piston	
End bearing	
Trunion	
Port plug	
Front stop ring	
Retaining ring	
Jettison switch activator assembly (down actuator assembly only)	
Stop ring	
1.13 Nose Fairing Assembly	
Protects window from accidental injury, prevents buffeting when hung externally in the windstream	
Fairing assembly	
Main frame	
Safety wire	
Fairing plug	

Name of Circuit, Stage, or Part	Function, if not Described by Name
1.13 Nose Fairing Assembly (Cont'd)	
Cylinder assembly	
Lock lever assembly	
Latch thumb lock	
Cover cap	
Main trigger assembly	
Power lever	
1.14 Base Plate Assembly	
	Purpose is to drive eye gyro to determined speed, then de-energize the motor and clutch permitting the eye gyro to coast
Motor mounting assembly	1/3 hp, 26 volt at 26 amps series
Motor relay	20 volt DPDT
Lower clutch assembly	
Centrifugal switch	
1.15 Stabilizer	
	Establishes a fixed plane in space to establish a missile target line, provides a detector and target scanning method for intelligence for missile homing; and re-establishes missile target line as missile moves in space relative to the target
Nozzle assembly	
Gimbol and rotor housing assembly	
Caging assembly	
Base plate assembly	
Stabilizer housing assembly	
Mirror shaft assembly	
Rotor housing assembly	
Pinion and gear assembly	
Brush holder wiring assembly	
Plunger	
Upper clutch assembly	
1.16 Uncaging Mechanism	
	Locks the gimbol and rotor housing in a fixed position and to release them at proper time
Plunger pin	

Name of Circuit, Stage, or Part	Function, if not Described by Name

1.16 Uncaging Mechanism (Cont'd)

Plunger

Plunger guide

Plunger spring

Uncaging mechanism solenoid assembly

2. Tail Assembly

2.1 Hub and Propeller Assembly

Airscrew drive for generator 3,000 to 10,000 RPM

Hub

Blade

Set screw

Pin

2.2 Generator

Furnishes all electrical power;

Jack and Heintz type shunt generator;

Self cooled, designed for high altitude and low temperatures;

Speer - high altitude brushes;

3 pounds brush spring pressure for minimum generator noise;

2.3 Generator Voltage Regulator Assembly

Bendix type 40E29 barrel	Holds carbon pile stock
Carbon pile stock	Variable resistor - 1/2 mm discs
Spring loaded armature	Applies pressure to carbon pile stock
Regular coil	Measures output voltage and operates spring loaded armature

2.4 Undervoltage Relay

Transfers entire electrical load from warm-up cable receptocle to the generator.

2.5 Tail Transfer Relay

Provides signal to missile electronics at breakaway and isolates roll gyro in the coast period

Name of Circuit, Stage, or Part	Function, if not Described by Name
2.6 Dynamotor	
Furnishes high voltage for nose electronics;	
22 volts input, 480 volts at 165 ma;	
Input regulated by carbon pile regulator;	
No end caps, permit free air circulation	
2.7 Dynamotor Voltage Regulator Assembly	
Maintains high voltage output	
Bendix voltage regulator	
Carbon pile stock	
Compensations resistor	(Current sensing coil)
2.8 Fuze Arming Assembly	
Rotates fuze arming shaft for arming	
Motor assembly	Split-field series motor, 30 volt dc 12,000 rpm, centrifugal switches open series circuit at prescribed speed and closes just below this speed
Motor mount	
Clutch bearing	
Clutch shaft bearing	
Clutch shaft	
Aligning sleeve	
Pressure spring	
Fuze arming shaft	
Set screw	
Grip collar	
Fuze arming shaft sleeve	
2.9 Fuze Assembly - XB-44B	
2.10 Roll Control Gyro	
Gyro assembly	Detail roll error (angle and rote); Provide electrical signals to aileron pneumatic actuator valve solenoid for correction of roll; 2 gyros free 9500 rpm and rate 7500 rpm

Name of Circuit, Stage, or Part	Function, if not Described by Name
2.10 Roll Control Gyro (Cont'd)	
Relay	Controls aileron valves
Microswitch	Breakaway transfer
Gyro plug	
Rate limit contacts	
Commutator (phenolic with 180° silver segment)	
Stable pick-off brush	
Uncaging solenoid	
2.11 Bulkhead and Bottle Assembly	
Bulkhead	Structural member of the tail section and supports the storage bottle, pneumatic regulator, generator, roll gyro, and tail fins
Bottle assembly	Supplies and regulates dry nitrogen gas for the tail pneumatic system
Gas bottle	Holds 200 psi charge; capacity of 57 in 3; tapered thread
Bulkhead	Mounting for bottle assembly and structural member of the tail
Regulator body	
Plug, arming valve	Seals high pressure charge
Diaphragm	Regulate low pressure
Thrust pin (stem)	High pressure to low pressure reduction
Seat	Nylon seat for thrust pin
Spring	Thrust pin spring
Adjusting spring	Balances diaphragm push and thrust pin spring
Set screw	
"O" ring	
Charging valve body assembly	Valve
Tail arming mechanism assembly at breakaway	Signals nose; releases high pressure; starts fuze arming motor; uncages roll control gyro.

Name of Circuit, Stage, or Part	Function, if not Described by Name

2.12 Actuator Valve Assembly (Solenoid)

Provides 2 way gas control mechanism, delivering gas at 225 and 150 psi to pistons of deflectors and piston for roll control respectively

Solenoid assembly

Valve body

Piston and plunger assembly

Return spring

Valve piston

Valve sleeve

Plunger stop

Compensating spacer

End cap

Mounting block

2.13 Actuator - Tail Pneumatics

Cable and 90° linkage drive 4 ailerons 16° for CCW roll (energized) and 16° for CW roll (de-energized)

Actuator body

Piston and piston block

Rod, adjusting

End cap bearing

Jam nut

2.14 Tail Skins, Tail Fairing and Nose Skirt Assembly

3. Preflight Checkout Console; Main Control Unit

3.1 480 Volt dc Power Supply

Series regulator tubes (parallelled)	Control output voltage
Dc amplifier tube	Controls series regulator tubes
Voltage reference tube	Maintains reference voltage
Vacuum diode rectifiers	Provides full wave rectification
Condenser input filter	Provides voltage regulation and ripple reduction
Power transformer	Supplies ac voltages

Name of Circuit, Stage, or Part	Function, if not Described by Name
3.2 30 Volt dc Power Supply	
Bridge, copper oxide rectifier	Provides low voltage, full wave rectification
Power transformer	Supplies 40 volts ac from 117 volts ac
3.3 250 Volt dc Power Supplies "A", "B", and "C"	
"A" Supply	
Series regulator tubes (parallelled)	Controls dc output voltage
Dc vacuum tube amplifier	Controls series regulator tubes
Vacuum diode rectifier	Provides full wave rectification
Condenser input, pi filter	Provides voltage regulation and ripple reduction
Note: "B" and "C" supplies differ only in numbering, and only "A" supply has interlock switch with lamp indicator.	
3.4 Timer Chassis (Chassis Number 1)	
Interrupting circuit relay control triode	Control current for interrupting relay
Interrupting circuit relay	Opens holding circuits for other relays
Electronic timer relay control vacuum triode	Controls timer relay current
3 second timer relay	Energizes Miller type integrator timer; connects to voltage check test circuit
Miller type integrator timer vacuum dual triode	Controls grid voltage of resistor coupled triode for good reliability and repeatability of timing
60 second timer relay	Connects stepper switch to output of repeat cycle timer
Stepper switch	5 banks of 50 steps per bank
Repeat cycle timer	Keys stepper, one pulse per second
3.5 Test Circuits Chassis (Chassis Number 2)	
Aileron Test Circuit	
Relay control triode	Controls relay current
Relay	Operates "Go-No-Go" line
Relay	Operates R-C timing circuit

Name of Circuit, Stage, or Part	Function, if not Described by Name
3.5 Test Circuits Chassis (Chassis Number 2) (Cont'd)	
Deflector Detector Circuit	
Relays	Control deflector detector relays
Relays	Control "Go-No-Go" indication
Torque Motor Test Circuit	
Vacuum triode amplifiers	Amplify pulses of longer than one second duration
Relays	Operate "Go-No-Go" line
Voltage reference dual triode vacuum tube	Establishes cathode bias
Jettison Test Circuit	
Relay	Operate "Go-No-Go" line and signal lamps
Relay	Switch high and low current reference
Rev-up Test Circuit	
Relay	Controls "Go-No-Go" relay
Relay	Controls "Go-No-Go" line
Shunt	Measure gyro motor starting current to operate relay K225
"B" Delay Test Circuit	
Vacuum triode relay control tube	Controls timing relay current
Relay	Opens "Go-No-Go" line except for proper input signal
Relay	Controls "Go-No-Go" line
Electrical Uncage Signal Test	
Vacuum triode relay control tube	Operates timer relay
Relay	Operates "Go-No-Go" line
Electronic Voltmeter Circuits	
Dual triode difference voltage amplifier	Compares 31.50 dc with reference
Power amplifiers	Operate relay to control "Go-No-Go" circuit

Name of Circuit, Stage, or Part	Function, if not Described by Name
3.5 Test Circuits Chassis (Chassis Number 2) (Cont'd)	
Dual triode difference amplifier	Compares 480 volt load current to reference
Power amplifiers	Operate relay to control "Go-No-Go" circuit
Relays	Control indicator lamp relays
Electronic Milliameter Circuit	
Dual triode difference amplifier	Compares 480 volt load current to reference
Dual triode voltage amplifiers	Drive power amplifiers
Power amplifiers	Operate relay to control indicators
Tail Gyro Test Circuit	
Relay	Controls "Go-No-Go" line
Self-Check Test	
Relays	Supply electrical signals to console to simulate proper response of missile to programmed tests
4. Preflight Checkout Console; Nose Unit	
Heaters	Provide infra-red signals
Relays	Operate heaters
Solenoid, shutter operator	Uncovers heater signal at proper instant
Solenoid, pneumatic control	Controls nose arming device
5. Tail Unit	
Tail drive motor	Drives tail generator
Oscillator motor	Drives roll simulation platform
Solenoid, pneumatic control	Controls tail arming device

APPENDIX G

TROUBLE SHOOTING: STANDARD TEST SETS ISSUED FOR USE WITH EACH MISSILE AND ITS ASSOCIATED EQUIPMENT

APPENDIX G

TROUBLE SHOOTING: STANDARD TEST SETS ISSUED FOR USE WITH EACH MISSILE AND ITS ASSOCIATED EQUIPMENT

Terrier

Audio-oscillator
Bolometer
Capacity divider
Directional couplers
Calibrated microwave attenuator
Decade capacitors
Decade resistances
Megger
Impedance bridge
Multimeter
Oscilloscope
Power bridge meter
Pulse generators
Rf signal generator
Spectrum analyzer
Frequency meter
Synchroscope
Termaline wattmeter
Tube tester
Ac VTVM
Dc VTVM
Variacs
Wheatstone bridge

Regulus

Trounce Test Equipment

Delay generator	Rutherford A-2
Pulse train calibrator	Rutherford D-2
Magnetic oscillograph	Brush BL-222
Frequency meter	PRD-560-AS
Spectrum analyzer	PRD-853
Radar test set	AN/UPM-44
Oscilloscope	TS-239/UP
Signal generator	TS-403/U
Rf power meter	TS-125/AP
Rf frequency meter	TS-186/AP
Voltage divider	TS-89/AP
Vacuum tube voltmeter	TS-375A/U

Trounce Test Equipment (Cont'd)

Multimeter	TS-352/U
Signal generator	TS-497/URR
Frequency meter	TS-117
Oscilloscope	Tektronix 514
Crystal head set	
Grid dip meter Model 59	

Radio Command Control Test Equipment

Oscilloscope	OS-8/UB
Coder	KY-111/ARW
Audio oscillator	TS-382A/U
Vacuum tube voltmeter	ME-64/U
Vacuum tube voltmeter	TS-375A/U
Signal generator	SG-50/ARW
Twin power supply	Model 210 manufactured by Furst Electronics Corporation
Signal generator	Boonton 202B
Univerter	Boonton 207A
Signal generator	TS-418/U
Rf wattmeter and stub tuner	TS-118/AP
Low pass filter	Hewlett-Packard Model 360-A
Rf frequency meter	Gertsch Model FM-3
Rf signal generator	General Radio 1001-A
Harmonic wave analyzer	Hewlett-Packard Model 300-A
Audio signal generator	URM-25
Distortion and noise meter	General radio model 1932-A
Communications receiver capable of tuning to 5.1 megacycles	

Autopilot Test Equipment

Oscilloscope	OS-8/UB
Vacuum tube voltmeter	ME-6B/U
Multimeter	TS-352/U

Bendix Guidance Test Equipment (Missile)

Rf power meter	TS-125/AP
Oscilloscope	Dumont 256B
Two signal generators	TS-403/U
Rf frequency	TS-186/AP
Spectrum analyzer	PRD-853
Frequency meter	PRD-560
Ac vacuum tube voltmeter	ME-6B/U
Voltage divider	TS-89/AP
Vacuum tube boltmeter	TS-375A/U
Multimeter	TS-352/U

Bendix Guidance Test Equipment (Picket Station)

Oscilloscope	Tektronix Model 514D
Frequency meter	TS-166
Frequency meter	PRD-560
Signal generator	TS-403
Power meter	TS-125
Multimeter	TS-352/U
Vacuum tube voltmeter	TS-375/U
Voltage divider	TS-89/AP
Dummy load (50 ohm)	

Portable Squibb Checker

Interim Dive Path Controller Test Equipment

Frequency meter	JBT 41-FX
Oscilloscope	OS-8/UB
Multimeter	TS-352/U
Vacuum tube voltmeter	ME-30/U

General Purpose Test Equipment

Tube tester	Hickock 547A
Impedance bridge	TS-460/U
Megger	AN/PSM-4
Pressurization kit	MK-20A/UP
Dc (battery operated) vacuum tube voltmeter--Ballantine	
Crystal calibrator	Model 111, Measurements Corp.
URF Admittance Meter	Type 1602A, General Radio Co.
Five multimeters	TS-362/U
Vacuum tube voltmeter	ME-6B/U
EPUT meter	Berkeley Instrument Co., Model 700
Twin power supply	Model 210, Furst Electronics Corp.

Sparrow I

IS-189 multimeter
Ballantine 300 VTVM
Weston 622 VTVM
Leeds and Northrup Kelvin bridge ohmmeter #4286
Dumont 304 H oscilloscope
Hewlett-Packard 202A audio-oscillator
Hewlett-Packard 200C audio-oscillator
Sanborn #60-1300 dual-channel recorder
Precision Scientific Co. Model 124B laboratory oven
Berkeley Model 554 EPUT meter

Starrett #711-F dial indicator
Surface plate
Taft and Pierce Style 9161 parallel box
Starrett #246 planer and shaper gage
Starrett #458 heighth gage
Starrett #66 thickness gage
Ideal Lab Tool and Supply Co. #1406R Scorsby table
Chatillon Co. #154-2 spring scale
Standard Electric Timer Model MST
Weston Model 931 voltmeter (500v)
Simpson Model 260 multimeter
Decade resistor box (5 meg)
Biddle Type 7705 insulation tester
TS-352/U multimeter
Kalbfeld micro-miker Q-meter
General Radio Co. 602 N decade resistance box
General Radio Co. V-5 variac transformer
Hewlett-Packard Model 202B audio-oscillator
Krahn-Hite af oscillator square and sine wave, .02-20,000 cps
Dumont voltage calibrator type 264-B
Shallcross Mfg. Co. per cent limit bridge model 617-F

Petrel

General purpose equipment is contained in the Petrel test console. This equipment is listed in the breakdown of the Petrel Test Console in Appendix F.

Dove

Vacuum tube voltmeter with 100 meg ohm input impedance
Audio-oscillator 10 to 200 cycles
Microvolter, General Radio Type 7466 (or equivalent)
Direct-coupled oscilloscope
Ohmmeter